HYPER-SPECTRAL IMAGING METHODS AND DEVICES

RELATED APPLICATIONS

[0001] This application is a § 371 from PCT/US2005/007585 filed March 7, 2005, which claims priority benefit of provisional patent application Serial No. 60/550,614 filed March 6, 2004, which is incorporated by reference in its entirety and is a continuation-in-part of application Serial No. 10/832,684 filed April 26, 2004, each of which is incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates generally to methods and devices for hyper-spectral imaging, more particularly to MEMS-modulated-aperture imaging spectrograph systems and methods.

BACKGROUND OF THE INVENTION

[0003] Imagers employ either a two-dimensional (2D) multichannel detector array or a single element detector. Imagers using a 2D detector array measure the intensity distribution of all spatial resolution elements simultaneously during the entire period of data acquisition. Imagers using a single detector require that the individual spatial resolution elements be measured consecutively via a raster scan so that each one is observed for a small fraction of the period of data acquisition. Prior art imagers using a plurality of detectors at the image plane can exhibit serious signal-to-noise ratio problems. Prior art imagers using a single element detector can exhibit more serious signal-to-noise ratio problems. Signal-to-noise ratio problems limit the utility of imagers applied to chemical imaging applications where subtle differences between a sample's constituents become important.

[0004] Spectrometers are commonly used to analyze the chemical composition of samples by determining the absorption or attenuation of certain wavelengths of electromagnetic radiation by the sample or samples. Because it is typically necessary to analyze the absorption characteristics of more than one wavelength of radiation to identify a compound, and because each wavelength must be separately detected to distinguish the wavelengths, prior art spectrometers utilize a plurality of detectors, have a moving grating, or use a set of filter elements. However, the use of a plurality of detectors or the use of a macro moving grating has signal-to-noise limitations. The signal-to-noise ratio largely dictates the ability of the spectrometer to analyze with accuracy all of the constituents of a sample, especially when some of the constituents of